

# Compressed Gases

---



**BLR**  
BUSINESS LEARNING RESOURCES

## Slide Show Notes

- In this training session, we will discuss how to work safely with compressed gases. We will focus on the compressed gas systems and cylinders that are used in our workplace and how to protect ourselves from those hazards.

*This training session is a general overview of compressed gas safety. The Occupational Safety and Health Administration (OSHA) has many different requirements for compressed gas safety, from general requirements to requirements for specific gases and applications (i.e., welding).*

# Session Objectives

---

You will be able to:

- Identify compressed gases by the labels
- Safely transport, handle, and store compressed gas cylinders
- Safely use cylinders, regulators, and gauges
- Know the specific hazards of some common compressed gases

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

By the end of the training session, you will be able to:

- Identify compressed gases by the labels.
- Safely transport, handle, and store compressed gas cylinders.
- Safely use cylinders, regulators, and gauges.
- Know the specific hazards of some common compressed gases.

# Compressed Gases Can Be Deadly

---

- Employee killed when cylinder turned into a rocket because its valve was knocked off
- Employee suffocated after entering a space filled with nitrogen
- Facility damaged when acetylene cylinder heated up and exploded
- Employee's eyebrows singed when lighting a gas barbecue grill

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

Compressed gases can be very useful in both industry and at home; however, they can also be very dangerous. How many of these stories have you heard about or even witnessed?

- Employee killed when cylinder turned into a rocket because its valve was knocked off. A compressed gas cylinder becomes a rocket when its valve stem is knocked off because as the gas escapes, it propels the cylinder out of control.
- Employee suffocated after entering a space filled with nitrogen. Gases can fill a space and displace oxygen. Some industries even use gases, such as nitrogen, for the specific purpose of displacing oxygen.
- Facility damaged when acetylene cylinder heated up and exploded. Cylinders can explode or leak when they become damaged or are exposed to extreme weather conditions.
- Employee's eyebrows singed when lighting a gas barbecue grill. How many of you have turned on the propane gas on your barbecue grill and attempted to light it while the gas accumulates in the grill? Once the gas is finally ignited, it seems to erupt in a ball of flame and can singe your eyebrows if your face is too close.

# What Are Compressed Gases?

- Chemicals include: oxygen, argon, nitrogen, helium, acetylene, hydrogen, nitrous oxide, carbon dioxide, ammonia, chlorine
- Compressed gases used in bulk systems or portable cylinders
- Industry uses include welding, cutting, operating tools, transferring liquids, blowing agents, and laboratories

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- There are an endless variety of compressed gases available, such as: oxygen, argon, nitrogen, helium, acetylene, hydrogen, nitrous oxide, carbon dioxide, ammonia, chlorine. Compressed gas cylinders might contain only one type of compressed gas or special blend with multiple types of gases.
- Compressed gases can be used in bulk forms (i.e., large storage tanks) or brought on-site in portable cylinders.
- Industry uses compressed gases in many ways, including welding, cutting, operating tools (i.e., shop air), transferring liquids, blowing agents, and laboratories.

*What are the different types of compressed gases used in your department?*

# General Hazards

- Gases are under pressure
- Specific hazardous characteristic of each compressed gas
- Check MSDS for specific hazards



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Compressed gases have many potential hazards—the most significant being that they are compressed and under pressure. Containers could rupture, resulting in an explosion, or valves might be damaged and fail, which would launch the cylinder.
- Another significant hazard of compressed gases is the characteristics of the gases themselves. They might be flammable, corrosive, toxic, reactive, air displacing, etc.
- Check the material safety data sheet (MSDS) for any specific hazards or safety precautions. We will review the hazards of some of the more common compressed gases toward the end of this training session.

# Compressed Gas Labels

- Name of the compressed gas
- Hazards of the compressed gas
- NFPA labels
- DOT labels
- Never remove labels



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

Bulk systems and portable systems, or cylinders, have different labeling requirements.

- Both must be marked with the name of the compressed gas.
- Both must have a label indicating the hazards of the compressed gas.
- The National Fire Protection Association (NFPA) has labeling requirements for bulk tanks. The colored diamond-shaped labels indicate the different types of hazards. Blue = health. Yellow = reactivity and instability (formerly reactivity). Red = flammability.
- Cylinders must have Department of Transportation (DOT) labels if they are going to be transported between the vendor and your facility.
- Never remove any of the labels or markings from a cylinder or bulk storage system.

# Bulk Systems

- Built and maintained by qualified personnel
- Filled by trained and qualified personnel
- Tank and piping properly labeled
- Tank system protected from damage



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- A bulk compressed gas system should be built and maintained only by personnel who are properly trained in compressed gas systems.
- Most bulk systems are filled by personnel from the gas vendor who follow the proper procedures for filling the system.
- Make sure the tank and all the associated piping are properly labeled. You should be able to look at the pipe anywhere along the system and know what gas it contains. All user points should also be labeled so that the user knows what gas is being hooked up.
- The tank system and all associated piping must be protected from damage. This might include barriers around the tank or earthquake supports for the piping system.

# Labels, Bulk Systems— Any Questions?

- Any questions about the general hazards of compressed gases, labels, or bulk systems?



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Do you have any questions about the general hazards of compressed gases, labels, or bulk systems?



# Transporting Cylinders

---

- Receiving/shipping cylinders requires DOT hazardous materials training
- Use lift trucks or hoists with proper lifting equipment only
- Never use a sling or electromagnet to hoist a cylinder
- Never lift a cylinder by the valve cap

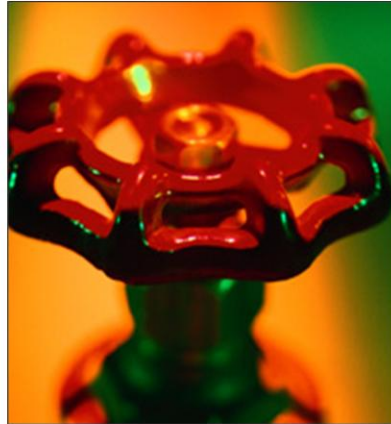
© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- In order to receive or prepare cylinders for shipment, you must be trained in DOT hazardous materials requirements.
- When transporting cylinders by hoist or forklift, use appropriate baskets or cradles that secure the cylinder and prevent it from banging around or falling.
- Never use a sling or an electromagnet to lift or hoist a cylinder. Cylinders could easily fall out of a sling, and electromagnets could fail or otherwise release a cylinder.
- Valve caps are not made to carry the weight of a cylinder, so never lift a cylinder by the cap.

# Handling Cylinders Manually

- Close the valve and put on the cap
- Do not walk cylinder by holding onto valve stem or cap
- Never roll a cylinder on its side
- Use a hand truck with a secure system



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Whenever moving a cylinder, always make sure the valve is closed and the cap is on. This means that the cylinder must be detached from any equipment, and the regulator must be removed.
- Do not walk a cylinder (i.e., rock it back and forth or roll it along the bottom edge) while holding onto the valve cap. The cap could come loose, causing you to drop the cylinder, and the exposed valve could be knocked off. Now your cylinder has been converted into a rocket.
- Never roll a cylinder on its side. Not only could this damage the cylinder, it also exposes the valve and cap to the hazard of striking a solid object while the cylinder is rolling.
- Use a hand truck that has a proper securing system such as a chain.

## Storing Cylinders

---

- Dry, well ventilated, protected from weather
- Away from combustibles, heat sources, electrical systems
- Not in elevators, staircases, hallways, etc.
- Oxygen separated from fuels

© Business & Legal Reports, Inc. 0606

### Slide Show Notes

- The cylinder storage area must be dry, well ventilated, and protected from weather such as rain, snow, and direct sunlight.
- Keep combustibles (i.e., wood, paper, cardboard) away from the storage area. Remove any heat sources such as machinery or welding practices. Do not allow a cylinder to become part of an electrical current.
- Do not store cylinders in elevators, staircases, hallways, etc., where people are often traveling. This will increase the risk of knocking over a cylinder.
- Oxygen needs to be stored away from fuel, because if ignited, the oxygen will make the fire spread quickly. Oxygen cylinders must be 20 feet away from fuel sources or separated by a 5-foot-tall, 1/2-hour fire wall.

## Storing Cylinders (cont.)

- Store cylinders upright
- Secure cylinders so they don't fall over
- Store cylinders with valve cap on
- No sparks, smoking, open flames
- Sign requirements



© Business & Legal Reports, Inc. 0606

### Slide Show Notes

- Store cylinders in an upright position.
- Secure cylinders with straps, chains, cords or other ways to prevent them from tipping or falling over.
- Make sure cylinders are stored with the valve cap on.
- Sparks, open flames, and smoking are not allowed near cylinder storage areas.
- Cylinder storage areas have various sign requirements depending on the type of gas being stored. Most storage areas will have “No Smoking” signs along with general “Danger,” “Caution,” or “Warning” signs.

# Using Cylinders

---

- Keep upright and secure
- Keep away from flames, sparks, electricity
- Keep oil, grease, flammables off cylinders
- Open valve by hand; if tools are required, don't use the cylinder
- Open valve slowly with hand to the side
- Don't tamper with safety devices

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- When using a cylinder, keep it upright and secure to prevent it from being knocked over.
- Always keep flames, sparks, and electricity away from cylinders. When welding nearby, protect the cylinders with heat-resistant blankets or tarps.
- Do not work with cylinders when your hands or gloves are greasy, oily, or contaminated with flammable substances.
- Open the valves by hand only. If the valve requires a tool, do not use the cylinder. You may accidentally put too much stress on the valve and cause it to break off.
- Open the valve slowly with your hand to the side, not above, the valve. Opening the valve quickly might put undue pressure on the regulator or other systems. Serious injury could occur if the valve were to fail when your hand is above it. Turn the valve with your hand to the side, because the valve handle could become a projectile if the valve were to fail.
- Never tamper with cylinder safety devices. You are putting yourself and others in danger.

*The welding standard, located in 29 CFR 1910.252-255, may have additional requirements for using and handling compressed gas cylinders.*

# Regulators and Gauges

- Regulator and gauge rated for the pressure
- Regulator must be compatible with gas
- Do not exchange gauge from one gas to another
- Use thread sealant approved for application
- Wear eye protection

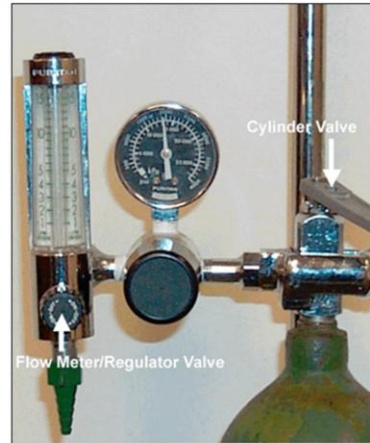


Image Credit: National Center for Patient Safety

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- The regulator and gauge must be rated for the pressure that will be applied from the gas system. Do not use a low-pressure regulator/gauge on a high-pressure gas system.
- Before installing the regulator, make sure it is compatible with the gas.
- Exchanging a gauge from one gas to another could cause a dangerous reaction.
- The thread sealant must also be approved for the application. The wrong sealant may react with the gas.
- Wear eye protection whenever operating a regulator and gauges. Although very rare, the regulator or gauge could fail.

# Leaking Cylinders

- Never try to repair
- Tag it, move it outdoors, and keep it away from heat or flame
- Call manufacturer or dealer



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Never try to repair a compressed gas cylinder.
- Tag the cylinder with information that warns others the cylinder is leaking and must not be used, move it outdoors if safe to do so, and keep it away from heat or flame. You may also need to secure the area to prevent people from getting too close to the leaking gas and to prevent people from smoking near the cylinder.
- Contact the manufacturer or local cylinder dealer for advice on how to handle the leaking cylinder. Consult the MSDS if necessary.

# General Cylinder Safety

---

- Only accept and use DOT-approved cylinders
- Do not drop cylinders
- Protect cylinders from cuts and abrasions
- Don't use cylinders for unintended function such as a roller or support
- Don't tamper with safety valves
- Keep caps on whenever not in use

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Only accept and use DOT-approved cylinders.
- Never drop a cylinder.
- Protect cylinders from cuts or abrasions that might be caused by banging into equipment or machinery.
- Never use a cylinder for any purpose other than its intended function of containing a compressed gas. Do not use the cylinder as a roller or some sort of support, such as a sawhorse.
- Never tamper with a cylinder's safety valves.
- Keep the valve stem caps on when cylinders are not in use.



# Compressed Gas Cylinders—Any Questions

- Any questions about how to safely handle, store, and use compressed gas cylinders?



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Do you have any questions about how to safely handle, store, and use compressed gas cylinders?

## LPG (Propane)

---

- Liquefied petroleum gas (LPG) includes propane, propylene, butane, butylene
- Liquid under pressure, released as a gas
- LPG containers must meet specific design criteria
- Cylinders have pressure relief valves
- Regulated by local fire department

© Business & Legal Reports, Inc. 0606

### Slide Show Notes

- LPG refers to propane, propylene, butane, and butylene. The most common is propane.
- LPG is liquid while under pressure; when released it converts to gas.
- LPG containers, including tanks and cylinders, must meet specific design requirements.
- Cylinders must have pressure relief valves.
- Propane use and storage is often regulated by the local fire department.

# LPG Hazards

- Flammable and reactive
- Propane is colorless and odorless
- Heavier than air, may build up and explode when ignited
- Adequate ventilation required



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Propane and other LPG gases are very flammable and often react with other chemicals.
- LPG is naturally colorless and odorless. A smell is added to propane so that a leak can be detected. Because different smells can be used, make sure you know the smell of your company's propane so that you can more easily detect a leak.
- LPG is heavier than air, so the gases may build up in a low-lying area and explode unexpectedly when ignited. They will also displace oxygen in a hole, pit, or sewer.
- Adequate ventilation is required when using an LPG such as propane. Never use your propane grill indoors or dispense propane from a tank into a cylinder indoors.

# LPG Containers

---

- Marked as an approved container
- Capacity and design pressure
- Shut-off valve, pressure-relief valve, level gauge
- Never use container not approved for LPG, corroded or damaged, or missing accessory

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- LPG can be stored only in a container that is marked as approved for LPG.
- The container must also be marked with its capacity (in pounds or gallons) and the design pressure (in pounds-per-square-inch gauge).
- Tanks and cylinders must have shut-off valves. Many tanks will also have other emergency shut-off devices that are located away from the tank. Cylinders and tanks must also have pressure-relief valves and level gauges.
- Never use a container that is not approved for LPG use, or is corroded or damaged (i.e., dented), or is missing an accessory.

# LPG Handling

- Do not smoke near propane
- Fill or dispense outside
- Wear gloves and goggles
- Secure cylinder to forklift or hand truck
- Report damaged cylinders
- Check for leaks



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Do not smoke when riding a propane-powered lift truck, when dispensing or filling a propane cylinder, or anywhere within 25 feet of a propane tank.
- Fill or dispense propane outside or in a very well ventilated room only.
- When filling propane cylinders, wear personal protective equipment (PPE) such as gloves and goggles. Remember, as the propane converts from liquid to gas, it is very cold and can freeze metal or your skin. Always wear gloves.
- Make sure the cylinder is always secured to your forklift, hand truck, or against the wall for storage.
- Report any cylinders with damage such as corrosion, dents, bent valves, etc.
- A propane leak can be detected in three ways: hissing sound, distinct odor, freezing near the leak outlet

# Compressed Air

---

- Flying fragments penetrate eyes and skin
- Compressed air can penetrate skin, damage eyes and ears
- Use lowest pressure for the task
- Wear eye and skin protection
- Store air hose properly and inspect regularly

© Business & Legal Reports, Inc. 0606

## Slide Show Notes

Compressed air is used in many industrial settings for operating machinery, operating air tools, or even sweeping.

- Compressed air can cause flying fragments or debris to penetrate your eyes or skin.
- Compressed air itself might also penetrate the skin or even damage your eyes and ears.
- Use the lowest pressure needed for the task. OSHA even requires that air wands used for sweeping have pressure relief valves and are limited to 30 pounds of pressure.
- When using compressed air for sweeping or for operating air tools, wear eye and skin protection.
- Store the air hose properly. Do not allow it to lie on the ground where it can be stepped on, run over by carts or forklifts, and damaged. Inspect your air hose on a regular basis for cracks or splits.

# Oxygen

- Does not burn or explode by itself
- Supports combustion process
- Explosive with acetylene, hydrogen
- Never handle with oily hands or gloves



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Oxygen will not burn or explode by itself.
- Oxygen supports the combustion process. It is not a fuel. However, if it were to leak near a fuel source that became ignited, it would cause the flame to expand and grow in an almost explosive manner.
- Oxygen can be explosive when used with acetylene or hydrogen.
- Never handle an oxygen cylinder or bulk system with oily hands or gloves. You might just be providing the fuel that the oxygen needs to start a fire.

# Acetylene

- Flammable
- Cylinder packed with porous material and solvent that holds the acetylene
- Once the valve is opened, the acetylene flows out in gaseous form
- Pressure relief valve using fusible metal that melts at about 212°F



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Acetylene is a very flammable gas that is often used for welding or cutting purposes.
- The acetylene cylinder is different from other gas cylinders in that it is filled with a porous material that is saturated with a solvent. The solvent absorbs, or holds, the acetylene while it is under pressure.
- Once the cylinder valve is opened, the acetylene gas flows out of the cylinder.
- Acetylene cylinders have pressure-relief valves because of the material they hold. If the cylinder is heated up without the relief safety valve, the cylinder could explode. The relief safety valve is set for approximately 212 degrees, or about the temperature of boiling water. Be careful not to trigger the safety relief valve by putting the cylinder too close to molten metal or inadvertently directing the flame of your torch toward the valve. If the valve freezes, do not thaw with boiling water (it could melt the fusible metal). Instead, use lukewarm water.



## Other Gases

---

- Gases such as argon and nitrogen are used to displace air
- Helium could cause rapid suffocation
- Gases such as ammonia and chlorine will cause large evacuations even for small leaks

© Business & Legal Reports, Inc. 0606

### Slide Show Notes

- Even inert gases such as argon and nitrogen can be deadly because they will displace air and are often heavier than air. If a pit, tank, or other confined space is located near a tank of inert compressed gas, it could be filled with the gas if there were a leak. Before entering the space, be sure to check it for oxygen content.
- Helium cylinders can be found in many stores because it is used to fill balloons. Many people have sucked on a helium balloon because it changes their voice and it can be very funny to hear them talk. However, this practice can be deadly. Too much helium will block the oxygen flow and cause rapid suffocation, which can render a person unconscious.
- Ammonia and chlorine gases are very irritating at levels well below their permissible exposure level (PEL) concentrations. Even a small leak can cause a massive evacuation due to the irritating effects.

# Common Compressed Gases—Any Questions?

- Any questions about the hazards of any of these common compressed gases?



© Business & Legal Reports, Inc. 0606

## Slide Show Notes

- Do you have any questions about the hazards of any of these common compressed gases?

## Key Points to Remember

---

- Cylinders must always be stored and secured properly
- Handle and move cylinders safely
- Cylinders and bulk systems must be properly labeled
- Know the hazards of a compressed gas before using it

© Business & Legal Reports, Inc. 0606

### Slide Show Notes

- Cylinders must always be stored and secured properly.
  - Handle and move cylinders safely.
  - Cylinders and bulk systems must be properly labeled.
  - Know the hazards of a compressed gas before using it.
- 
- Now take the test for credit! Hope you learned a few things about this subject!